PARASITES OF FISHES FROM ALGONQUIN PARK LAKES

1989
ONTARIO FISHERIES TECHNICAL REPORT SERIES NO. 29

Alex O. Dechtiar (deceased) and James A. MacLean
Ontario Ministry of Natural Resources
Box 5000, Maple, Ontario L6A 1S9

and

Stephen J. Nepszy
Ontario Ministry of Natural Resources
R.R. 2, Wheatley, Ontario N0P 2P0

C. H. Olver, Editor

Ontario Ministry of Natural Resources
Lyn McLeod
Minister

90-00196/

ISSN 0227-986X
ISBN 0-7729-5819-X

© 1989, Queen's Printer for Ontario

Printed in Ontario, Canada

Single copies of this publication are available at no charge from the address noted below. Bulk orders may involve charges.

Current publications of the Ontario Ministry of Natural Resources, and price lists, are obtainable through the Ministry of Natural Resources Public Information Centre, Room 1640, Whitney Block, 99 Wellesley St. West, Toronto, Ontario M7A 1W3 (personal shopping and mail orders).

Telephone inquiries about ministry programs and services should be directed to the Public Information Centre:

Fisheries Fishing Licence Sales	(416) 965-7883
Wildlife Hunting Licence Sales	965-4251
Provincial Parks	965-3081
Forestry Lands	965-9751
Aerial Photographs	965-1123
Maps	965-6511
Minerals	965-1348

Other government publications are available from Publications Ontario, Main Floor, 880 Bay St., Toronto. For mail orders write MGS Publications Services Section, 5th Floor, 880 Bay St., Toronto, Ontario M7A 1N8.

Cheques or money orders should be made payable to the Treasurer of Ontario, and payment must accompany order.

Parasites of Fishes from Algonquin Park Lakes

A. O. Dechtiar[1] and J. A. MacLean

Ontario Ministry of Natural Resources, Box 5000, Maple, Ont. L6A 1S9

and S. J. Nepszy

Ontario Ministry of Natural Resources, R.R. 2, Wheatley, Ont. N0P 2P0

Dechtiar, A. O., J. A. MacLean, and S. J. Nepszy. 1989. Parasites of fishes from Algonquin Park lakes. Ont. Fish. Tech. Rep. Ser. No. 29. 19 p.

This paper reports on a survey of parasites of fishes from Algonquin Park lakes between 1961 and 1971. A total of 1,829 individuals from 26 species of fish were examined and 126 species of parasites not recorded in other surveys by Bangham (1941), Bangham and Venard (1946) and others are listed. Every species of fish and 89% of the individuals examined carried at least one parasite species. A number of parasites that contribute to mortalities of fish were also recorded.

INTRODUCTION

Long-term studies of the factors that influence production and yield in fish populations have been conducted at the Harkness Memorial Laboratory in Algonquin Park since 1936. As one component of these studies, the parasites of fishes in Lake Opeongo and other lakes in the park have been studied since 1939, with one earlier brief report (Kuitunen-Ekbaum 1937). Bangham (1941) and Bangham and Venard (1946) examined 676 individuals of 22 species of fish and found 56 species of parasites and a prevalence of infection of 75.8%. Other investigators tended to focus on particular groups of parasites and they added 30 species to Bangham and Venard's list (Kuitunen-Ekbaum 1937; MacLulich 1943a, b; Mizelle and Donahue 1944; Fisher and Freeman 1969; Freeman and Thompson 1969; Tedla and Fernando 1970; Cannon 1972, 1973; Sinclair 1972; Befus and Freeman 1973a, b).

This study, for the period 1961-71, is the first extensive survey of fish parasite fauna in Algonquin Park lakes since 1939-42. Some additional work by the senior author on the parasites of brook trout (*Salvelinus fontinalis*) in natural and reclaimed lakes was also done in 1969-75, but has not been published and is not included here. The limited development of the area has maintained stable environmental conditions in the lakes, but cultural eutrophication in the bays, exploitation and introductions have caused changes in the aquatic communities of the park lakes in the past 30-40 years. This survey was designed to examine changes in the parasite fauna since earlier studies and to provide a more complete list of parasite species as a supplement to the continuing studies of the factors that influence production of fish.

[1]Deceased

MATERIALS AND METHODS

Most of the fish specimens were collected during early spring and fall with gill nets and trap nets from 42 lakes in Algonquin Park. However, yellow perch (*Perca flavescens*), cisco (*Coregonus artedii*) and lake whitefish (*Coregonus clupeaformis*) were taken throughout the year. Staff of the Harkness Memorial Laboratory, Algonquin Park, Ontario Department of Lands and Forests, provided specimens from their regular or special netting programs on these lakes. Each fish was thoroughly examined, usually while fresh and all parasites were preserved in 5% formalin, with the exception of crustaceans, molluscs and round worms, which were fixed in 70% ethanol and stored in glycerin-alcohol. Monogeneans and nematodes were later mounted, unstained in glycerin jelly. Digeneans, acanthocephalans and tapeworms were stained with Mayer's carmalum, borax carmine or Gomori's trichrome, cleared in beechwood creosote and mounted in Piccolyte. All parasites were identified by the senior author.

Many parasites from this survey are housed under the care of Dr. M. Beverley-Burton, College of Biological Sciences, University of Guelph, Guelph, Ontario and Dr. D.K. Cone, St. Mary's University, Halifax, Nova Scotia, pending their final destination at the National Museum of Natural Sciences, Ottawa, Ontario.

The original records showing the listing of fish sampled from respective lakes were not readily available from the file of the senior author. The lakes that were sampled for fish parasites were inferred from the Annual Reports of the Fisheries Research Section, Ontario Department of Lands and Forests, from 1961-1971. These lakes included the following: Animoosh, Big Red, Brewer, Cache, Canisbay, Costello, Cradle, Crevice, Crow, Dickson, Greenleaf, Happy, Happy Isle, Harness, Head, Hogan, Kearney, Kenneth, LaMuir, Lavieille, Lawrence, Little Major, Little Minnow, Louisa, Major, Merchants, Mykiss, Opeongo, Pine, Proulx, Red Pine, Redrock, Ryan, Sachigo, Sawlog, Shallnot, Shirley, Smoke, Sproule, Stringer, Tanamakoon, White Partridge.

RESULTS

A total of 181 species of parasites were found, and 126 are new records for fish parasites from Algonquin Park lakes. These new records are presented in this report and the following host-parasite checklist. The monogeneans formed the largest single group of parasites with 38 species, including *Dactylogyrus* (10 fish hosts), *Gyrodactylus* (16 hosts), *Octomacrum* (8 hosts), *Pellucidhaptor, Anonchohaptor* and *Acolpenteron* (each 1 host).

The protozoans were the second largest group with 23 species, including *Trichodina* (3 hosts) and *Ichthyophthirius* (5 hosts). The other groups included: 18 species of trematodes (Digenea); 12 species of Cestoidea; 13 species of Nematoda; 10 species of Acanthocephala; 7 species of Crustacea; 4 species of Hirudinea; and 1 species of Mollusca.

The new records of parasites are arranged in a host-parasite checklist and further summarized in Table 1 and Appendix A. The host fish species are arranged in order according to Robins et al. (1980). For each host species, the number of fish examined, the prevalence (%) of infection and the intensity and site of infection are given. Intensity of infection is indicated as: L (light, 1-9 parasites/host); M (medium, 10-49 parasites/host); H (heavy, $\geq$50 parasites/host). Parasites are listed in order of prevalence of infection. An asterisk before a parasite name indicates its presence in a larval or immature stage. Parasite taxonomy follows Margolis and Arthur (1979) and Beverley-Burton (1984), except where noted.

Table 1. Numbers of parasitic taxa in fish species from Algonquin Park lakes during two periods, 1939-42[1] and 1961-71 (in parenthesis).

Species	Proto-zoa	Di-genea	Mono-genea	Cest-oidea	Nema-toda	Acantho-cephala	Crust-acea	Mol-lusca	Other	Total species 1939-42	Total species 1961-71
Lake herring	(1)	(2)		1(2)			1	(1)		2	6
Lake whitefish		2(1)		3	2	1	1(1)			9	2
Round whitefish		2(1)	(1)	1	1(1)	(1)	1(1)	(1)		5	6
Brook trout	2	2(3)		2	2(1)	1(1)		(1)		9	6
Lake trout		2		2		1(1)	(1)			5	2
Splake		(3)		(1)	(1)			(1)		-	6
Redbelly dace	(2)	3(2)	(4)	1	2(1)	1	(1)			7	10
Finescale dace	(3)	1(3)	1(3)	(2)	1(2)					3	12
Golden shiner	(2)	1(4)	(5)	(2)	(1)	(2)	(1)	(1)		1	18
Common shiner	(3)	8(2)	1(3)	2	1(2)	1(1)	1(1)	(2)		14	14
Fathead minnow	(1)	3(2)	(3)	(2)	1					4	8
Bluntnose minnow	(1)	3(3)	(1)	1(1)	2		(1)			6	7
Fallfish		4(2)		1	1(1)		1(1)			7	4
Creek chub	(1)	8(2)	2(9)	2(1)	2(2)	1(2)	(1)	(1)	(1)	15	20
Lake chub	(1)	(1)	(3)							-	5
Pearl dace	(1)	3(1)	1(2)		1(1)				(1)	5	6
White sucker	(2)	5(3)	2(6)	4(2)	2(4)	4(3)	1(1)		1	19	21
Longnose sucker	(1)	1(2)	(5)	1(2)	1(1)	1(2)	1(1)	(1)	(1)	5	16
Brown bullhead	1(1)	9(1)	1(2)	3	5(1)	2	1(1)			22	6
Trout perch	(1)	(3)	(2)							-	6
Burbot	(1)	1	(1)	2	3	1(1)	2(1)		(1)	9	5
Brook stickleback	(1)	(3)	(2)	(2)	(4)	(2)	(1)			-	15
Pumpkinseed	1(4)	10(1)	1(1)	5(2)	6(2)	1(2)			(1)	24	13
Smallmouth bass	(1)	11(1)	1(3)	4(1)	5(1)	2	(2)			23	9
Yellow perch	(5)	10(1)	1(1)	4	5(3)	1		1	1	23	10
Slimy sculpin		(2)	(2)		(2)					-	6

[1]From Bangham (1941); Bangham and Venard (1946).

Coregonus artedii Lesueur - lake herring
Examined 33: Prevalence 70%

Proteocephalus exiguus	15%	L	intestine
**Tetracotyle intermedia*	15%	M	heart
*Glochidia	15%	M	gills
**Diphyllobothrium ditremum*	9%	L	stomach wall
**Diplostomulum spathaceum*	9%	L	eye
Pleistophora sp.	3%	H	muscle

Coregonus clupeaformis (Mitchill) - lake whitefish			
Examined 48: Prevalence 79%			
**Tetracotyle intermedia*	10%	M	heart
Ergasilus elongatus	6%	L	gills
Prosopium cylindraceum (Pallas) - round whitefish			
Examined 43: Prevalence 65%			
Tetraonchus variabilis	28%	M	gills
Philometra sp.	16%	H	body cavity
Salmincola thymalli	16%	M	gills
Acanthocephalus jacksoni	12%	L	intestine
*Glochidia	12%	M	gills
**Tetracotyle intermedia*	5%	L	heart
Salvelinus fontinalis (Mitchill) - brook trout			
Examined 95: Prevalence 63%			
**Hysterothylacium brachyurum*[1]	26%	M	liver, mesenteries
Hysterothylacium brachyurum	25%	M	intestine
**Tetracotyle intermedia*	12%	M	heart, kidney
Acanthocephalus jacksoni	12%	M	intestine
**Diplostomulum spathaceum*	9%	L	eye
*Glochidia	8%	M	gills
**Apophallus imperator*	5%	M	skin
Salvelinus namaycush (Walbaum) - lake trout			
Examined 74: Prevalence 81%			
Acanthocephalus jacksoni	7%	M	intestine
Ergasilus elongatus	3%	L	gills
Salvelinus fontinalis x *S. namaycush* - splake			
Examined 13: Prevalence 100%			
Hysterothylacium brachyurum	54%	L	intestine
Crepidostomum farionis	54%	M	intestine
Eubothrium salvelini	23%	L	intestine
**Hysterothylacium brachyurum*	23%	L	liver
**Tetracotyle* sp.	23%	L	heart
*Glochidia	15%	L	gills
**Diplostomulum spathaceum*	15%	L	eye
Phoxinus eos (Cope) - redbelly dace			
Examined 42: Prevalence 29%			
Dactylogyrus chrosomi	24%	L	gills
Gyrodactylus sp.	19%	L	fins

[1]Nomenclature according to Deardorff and Overstreet (1980).

Dactylogyrus eos	12%	L	gills
Trichodina sp.	12%	L	ureters
Rhabdochona canadensis	12%	L	intestine
Myxobolus conspicuus	5%	L	skin
*Glochidia	5%	L	gills
Phyllodistomum sp.	5%	L	ureters
Octomacrum semotili	5%	L	gills
**Clinostomum marginatum*	5%	L	gills

Phoxinus neogaeus Cope - finescale dace
Examined 74: Prevalence 87%

Dactylogyrus chrosomi	45%	L	gills
Gyrodactylus sp.	34%	L	fins
Trichodina sp.	14%	H	ureters
Octomacrum semotili	14%	L	gills
Pliovitellaria wisconsinensis	7%	L	intestine
Thelohanellus notatus	4%	L	lower jaw
**Spiroxys* sp.	4%	L	mesentery
Rhabdochona canadensis	4%	L	intestine
**Paradilepis* sp.	3%	L	mesentery
**Tetracotyle* sp.	3%	L	mesentery
Myxobolus conspicuus	3%	L	skin
Phyllodistomum sp.	3%	L	ureters

Notemigonus crysoleucas (Mitchill) - golden shiner
Examined 123: Prevalence 97%

Dactylogyrus parvicirrus	52%	M	gills
Gyrodactylus sp.	44%	M	fins
Octomacrum microconfibula	16%	L	gills
Pomphorhynchus bulbocolli	12%	L	intestine
*Glochidia	7%	L	gills, fins
Allocreadium lobatum	7%	L	intestine
Phyllodistomum sp.	7%	L	ureters
Myxosoma cyprini	4%	L	gills
Neoechinorhynchus notemigoni	4%	L	intestine
**Ligula intestinalis*	3%	L	body cavity
Pliovitellaria wisconsinensis	2%	L	intestine
Ergasilus sp.	2%	L	gills
**Clinostomum marginatum*	2%	L	muscles
Myxobolus notemigoni	2%	L	skin
Dactylogyrus luxili[1]	2%	L	gills
Dactylogyrus aureus	2%	L	gills
Rhabdochona sp.	2%	L	intestine
**Echinochasmus* sp.	2%	L	gills

[1]*Dactylogyrus luxili* was initially reported in Canada from *Notropis cornutus* (Hanek et al. 1975) and our finding constitutes a new host record.

Notropis cornutus (Mitchill) - common shiner
Examined 110: Prevalence 82%

Dactylogyrus luxili	29%	L	gills
Phyllodistomum notropidus	23%	L	ureters
Myxobolus sp.	18%	M	gills
**Diplostomulum spathaceum*	14%	L	eye
Pomphorhynchus bulbocolli	11%	L	intestine
**Proteocephalus ambloplitis*	9%	L	liver
Octomacrum microconfibula	5%	L	gills
Gyrodactylus sp.	5%	M	fins
**Spiroxys* sp.	4%	L	mesentery
Rhabdochona sp.	4%	L	intestine
*Glochidia	3%	M	gills, fins
Ergasilus sp.	3%	L	gills
Dermocystidium sp.	2%	H	gills
Eimeria degiustii	2%	H	intestine

Pimephales promelas Rafinesque - fathead minnow
Examined 20: Prevalence 100%

**Crassiphiala bulboglossa*	40%	L	fins
Octomacrum semotili	30%	L	gills
**Ligula intestinalis*	20%	L	body cavity
**Diplostomulum spathaceum*	15%	L	eye
Dactylogyrus bifurcatus	15%	M	gills
Nosema pimephales	10%	L	muscles
Gryodactylus lacustris	10%	L	fins
Pliovitellaria wisconsinensis	10%	L	intestine

Pimpehalus notatus (Rafinesque) - bluntnose minnow
Examined 16: Prevalence 100%

Dactylogyrus bifurcatus	75%	L	gills
**Clinostomum marginatum*	63%	M	muscles
**Diplostomulum flexicaudum*	25%	L	eye
Pliovitellaria wisconsinensis	19%	L	intestine
**Crassiphiala bulboglossa*	19%	L	fins, skin
Ergasilus sp.	13%	L	gills
Eimeria degiustii	13%	M	intestine

Semotilus corporalis (Mitchill) - fallfish
Examined 5: Prevalence 100%

Rhabdochona canadensis	80%	L	intestine
Ergasilus sp.	60%	L	gills
**Diplostomulum scheuringi*	40%	L	eye
**Crassiphiala bulboglossa*	40%	L	fins

Semotilus atromaculatus (Mitchill) - creek chub
Examined 139: Prevalence 93%

Neoechinorhynchus saginatus	19%	M	intestine
Octomacrum semotili	15%	L	gills
**Crassiphiala bulboglossa*	11%	M	skin, fins
Dactylogyrus microphallus	11%	M	gills
*Glochidia	8%	L	gills
Ichthyophthirius multifiliis	7%	M	fins
Gyrodactylus sp.	7%	M	fins
Pomphorhynchus bulbocolli	6%	L	intestine
Rhabdochona canadensis	5%	L	intestine
Ergasilus sp.	4%	L	gills
**Spiroxys* sp.	4%	L	mesentery
Cleidodiscus brachus	4%	L	gills
Dactylogyrus atromaculatus	4%	L	gills
Dactylogyrus semotili	3%	L	gills
Dactylogyrus lineatus	3%	L	gills
Dactylogyrus attenuatus	2%	L	gills
Piscicola sp.	2%	L	fins
**Ligula intestinalis*	2%	L	body cavity
Octomacrum microconfibula	1%	L	gills
Phyllodistomum scmotili	1%	L	ureters

Couesius plumbeus (Agassiz) - lake chub
Examined 9: Prevalence 100%

**Crassiphiala bulboglossa*	67%	L	fins
Octomacrum semotili	56%	L	gills
Dactylogyrus banghami	56%	M	gills
Gyrodactylus couesius	33%	M	fins
Myxobolus couesii	33%	M	eye

Semotilis margarita (Cope) - pearl dace
Examined 37: Prevalence 92%

Dactylogyrus banghami	30%	L	gills
**Tetracotyle* sp.	30%	L	mesenteries
Myxosoma pendula	14%	L	gills
Rhabdochona canadensis	14%	L	intestine
Piscicola sp.	5%	L	fins
Cleidodiscus brachus	5%	L	gills

Catostomus commersoni (Lacepède) - white sucker
Examined 201: Prevalence 98%

Acolpenteron catostomi	21%	L	ureters
Phyllodistomum lysteri	15%	L	ureters
**Ligula intestinalis*	12%	L	body cavity
Myxosoma bibullatum	12%	L	gills
Anonchohaptor anomalum	10%	L	gills
Pseudomurraytrema copulatum	10%	L	gills

Pseudomurraytrema alabarrum	8%	L	gills
Pellucidhaptor nasalis	7%	L	nasal cavity
Philometra sp.	5%	M	body cavity
Philometra nodulosa	4%	L	fins
Neoechinorhynchus cristatus	4%	M	intestine
Neoechinorhynchus crassus	4%	M	intestine
Rhabdochona ovifilamenta	4%	L	intestine
Sanguinicola sp.	3%	M	blood
Ergasilus sp.	3%	M	gills
Gyrodactylus spathulatus	3%	H	fins
**Tetracotyle* sp.	3%	L	mesenteries
**Clinostomum marginatum*	3%	M	muscle
**Eustrongylides tubifex*[1]	3%	L	mesenteries
Biacetabulum sp.	2%	L	intestine
Neoechinorhynchus strigosus	1%	L	intestine

Catostomus catostomus (Forster) - longnose sucker
Examined 80: Prevalence 88%

Acolpenteron catostomi	14%	L	ureters
Anonchohaptor anomalum	13%	L	gills
Pellucidhaptor catostomi	10%	M	nasal cavity, fins
**Eustrongylides tubifex*	8%	L-M	mesenteries
**Ligula intestinalis*	8%	L	body cavity
Gyrodactylus sp.	6%	M-H	fins, gills
Octomacrum lanceatum	6%	L	gills
Phyllodistomum lysteri	6%	L	ureters
Ichthyophthirius multifiliis	6%	M	skin
Pomphorhynchus bulbocolli	5%	M	intestine
Actinobdella sp.	4%	L	operculum (inside)
**Tetracotyle* sp.	4%	L	mesenteries
Ergasilus caeruleus	3%	M	gills
Hunterella nodulosa	3%	M	intestine
*Glochidia	3%	M	gills
Neoechinorhynchus crassus	3%	M	intestine

Ictalurus nebulosus (Lesueur) - brown bullhead
Examined 99: Prevalence 97%

Gyrodactylus nebulosus	15%	M	fins
Ergasilus sp.	5%	L	gills
Henneguya exilis	5%	M	gills
Ligictaluridus monticellii[2]	4%	L	nasal cavity
**Eustrongylides tubifex*	4%	L	mesentery
**Diplostomulum spathaceum*	4%	M	eye

---

[1]Nomenclature according to Sprinkle Fastzkie and Crites (1977).

[2]The identification of *Ligictaluridus monticellii* in this survey as the first North American sighting predates that presented by Klassen and Beverley-Burton (1985) from *Ictalurus nebulosus* of Lake Erie.

Percopsis omiscomaycus (Walbaum) - trout-perch
Examined 1: Prevalence 100%

**Diplostomulum spathaceum*	100%	L	eye
**Tetracotyle* sp.	100%	L	mesenteries
**Diplostomulum scheuringi*	100%	L	eye
Myxosoma procerum	100%	L	skin
Gyrodactylus sp.	100%	L	fins
Cleidodiscus baldwini	100%	L	gills

Lota lota (Linnaeus) - burbot
Examined 43: Prevalence 100%

Trichodinella sp.	33%	H	gills
Cystobranchus verrilli	28%	L	gills
Acanthocephalus jacksoni	5%	L	intestine
Gyrodactylus sp.	5%	L	intestine
Ergasilus celestis	5%	M	gills

Culaea inconstans (Kirtland) - brook stickleback
Examined 154: Prevalence 94%

Dactylogyrus eucalius	32%	L	gills
Gyrodactylus eucaliae	32%	M	fins
Bunodera eucaliae	20%	L	intestine
**Diplostomulum spathaceum*	7%	L	eye
**Tetracotyle* sp.	7%	L	mesenteries
**Agamonema* sp.	6%	L	mesenteries
**Schistocephalus solidus*	6%	L	body cavity
Ichthyophthirius multifiliis	6%	L	fins, skin
Neoechinorhynchus rutili	5%	L	liver
Neoechinorhynchus pungitius	5%	L	intestine
**Hysterothylacium brachyurum*	5%	L	liver
**Spiroxys* sp.	3%	L	mesentery
**Eustrongylides tubifex*	3%	L	mesentery
**Proteocephalus* sp.	3%	L	intestine
Ergasilus sp.	3%	L	gills

Lepomis gibbosus (Linnaeus) - pumpkinseed
Examined 108: Prevalence 91%

Gyrodactylus sp.	19%	L	fins
**Diplostomulum spathaceum*	19%	L	eye
Ichthyophthirius multifiliis	18%	L	skin
Trichodina sp.	14%	M	gills, fins
Myxobolus osburni	14%	H	mesenteries
Pomphorhynchus bulbocolli	9%	L	intestine
Henneguya brachyura	8%	M	gills
**Paradilepis* sp.	7%	L	mesenteries
**Leptorhynchoides thecatus*	7%	L	intestine
**Eustrongylides tubifex*	7%	L	mesenteries
**Dilepis* sp.	7%	L	mesenteries

**Raphidascaris canadensis*	3%	L	intestine
Myzobdella moorei	3%	L	fins

Micropterus dolomieui Lacepède - smallmouth bass
Examined 84: Prevalence 100%

Proteocephalus ambloplitis	94%	M-H	mesenteries, gonads
Syncleithrium fusiformis	24%	L	gills
Myxobolus inornatus	12%	M	muscle
Gyrodactylus macrochiri	12%	L	fins, muscle
Ergasilus centrarchidarum	11%	L	gills
Achtheres micropteri	6%	L	gill arches
Camallanus oxycephalus	5%	L	intestine
Cleidodiscus megalonchus	5%	L	gills
**Apophallus brevis*	2%	L	muscle

Perca flavescens (Mitchill) - yellow perch
Examined 163: Prevalence 96%

**Apophallus brevis*	12%	L-M	fins, muscle
Trichodina sp.	9%	H	fins
Trichodina urinaria[1]	9%	H	ureters
Ichthyophthirius multifiliis	4%	H	skin
**Eustrongylides tubifex*	3%	L	mesenteries
Sanguinicola occidentalis	3%	L	blood
Gyrodactylus freemani	2%	L	fins
Henneguya doori	2%	M	gills
**Hysterothylacium brachyurum*	2%	M	mesenteries
**Raphidascaris canadensis*	2%	M	liver

Cottus cognatus Richardson - slimy sculpin
Examined 10: Prevalence 100%

**Tetracotyle* sp.	90%	M	mesenteries
Rhabdochona cotti	50%	L	intestine
Spinitectus gracilis	30%	L	intestine
Crepidostomum sp.	20%	L	intestine
Gyrodactylus bairdi	20%	M	gills, fins
Dactylogyrus buddi	20%	L	gills

PATHOLOGY

No major mortalities of fish populations in Algonquin Park lakes attributable to the effects of parasites have been recorded, except perhaps for yellow perch in Lake of Two Rivers (A. Dechtiar, unpubl. data).

PROTOZOA

Protozoan parasites were found on 18 different species of fishes. *Ichthyophthirius multifiliis* was found on yellow perch, pumpkinseed, longnose

[1]Identification confirmed by Dr. J. Lom (Czechoslovak Academy of Science).

sucker, creek chub and brook stickleback. This parasite causes weight loss, hyperplasia and depletion of mucous cells and may cause mortality (Davis 1944; Elser 1955; Allison and Kelly 1963; Lahav and Sarig 1973; Hines and Spira 1974). Microsporidian (genus *Pleistophora*) and myxosporidian parasites (genera *Myxobolus, Henneguya, Eimeria* and *Myxosoma*) were found on the gills, muscle, skin and internal organs of 12 fish species. The most potentially harmful in Lake Opeongo are *Pleistophora* sp. in the muscle of the lake herring (Putz et al. 1965) and *Henneguya doori* on the gills of yellow perch (Guilford 1963). Parasites of the genus *Dermocystidium*, which was found only on the common shiner, may cause heavy mortalities of fish (Allen et al. 1968).

TREMATODA: DIGENEA

Adult digenetic trematodes and especially metacercariae (larval stages) are known pathogens for both young and adults of some fish species. Fish mortalities have been attributed to *Sanguinicola* sp. (yellow perch); *Crepidostomum* sp. (lake herring); **Diplostomulum* sp. (lake herring, brook trout, splake); **Tetractoyle* sp. (lake herring, lake whitefish, round whitefish, brook trout); **Clinostomum marginatum* (redbelly dace, golden shiner, bluntnose minnow); and **Apophallus brevis* (smallmouth bass, yellow perch) (Meyer 1958; Wales 1958). *Crepidostomum farionis* may damage the mucosa of the intestine of trout (splake) in cases of heavy infection (Wales 1958).

MONOGENEA

Monogeneans such as *Octomacrum lanceatum, O. semotili* and species of the genera *Gyrodactylus* and *Dactylogyrus* are dangerous for fishes, particularly young individuals (Tripathi 1959; Prost 1963; Mizelle 1983).

CESTOIDEA

Eubothrium salvelini, which causes reduced growth, survival and swimming performance in young salmonid fishes (Smith and Margolis 1970), was found only in splake in this survey. By invading the mesenteries and gonads of smallmouth bass and other species, the plerocercoids of *Proteocephalus ambloplitis* may cause serious damage (Dechtiar 1972a, b). Extremely heavy infection was pointed out previously by Bangham (1941) and Bangham and Venard (1946). **Ligula intestinalis* was detected in creek chub, white sucker, and longnose sucker. Many young fish of these species, with a high prevalence of *Ligula intestinalis*, die during the autumn and winter (Arme and Owen 1968; Harris and Wheeler 1974). Plerocercoids of *Diphyllobothrium* sp. occurred in lake herring. Duguid and Sheppard (1944) recorded an epizootic among trout (*Salvelinus fontinalis*) and char (*Salvelinus namaycush*) and Wales and Vik (1965) considered that larvae of this parasite contributed to a major decline of *Salmo trutta* and *Salvelinus alpinus* in Norway.

ACANTHOCEPHALA

Pomphorhynchyus bulbocolli is considered a serious fish pathogen (Petrushevski and Kogteva 1954). Damage to the epithelim and proliferation of connective tissue were noted in white sucker and longnose sucker from different lakes in Algonquin Park.

NEMATODA

Adults and larval stages of *Philometra nodulosa*, and *Philometra* sp. were found in high intensities in the body cavities of white sucker and round whitefish. *Hysterothylacium brachyurum* and larval stages of *Eustrongylides tubifex* are considered pathogenic to fishes (Williams 1967). Adults of *H. brachyurum* were found in the intestines of brook trout and splake. Larvae of the species found in the livers of the above same hosts, as well as in brook stickleback and yellow perch, are particularly pathogenic (Williams 1967).

Cysts (10 mm diameter) of the large red, roundworm, *Eustrongylides tubifex*, which is pathogenic (Dechtiar 1972a, b; Cone and Anderson 1977), were found in the body cavities of white sucker, longnose sucker, brown bullhead, brook stickleback, pumpkinseed and yellow perch.

ANNELIDA: HIRUDINEA

The leeches are of minor importance as parasites of fish in Algonquin Park lakes, but they may occasionally cause fish mortalities (Thompson 1927; Rupp and Meyer 1954). Leeches were found on only four species: creek chub, pearl dace,

burbot and pumpkinseed.

ARTHROPODA: CRUSTACEA

Ergasilus sp., found on 12 species and *Salmincola thymalli*, found on round whitefish, are considered pathogens (Kabata 1970). *Ergasilus* sp. feed on the epithelium and can seriously damage the gills causing impaired respiration, epithelial hypertrophy and anemia. Glochidia were encountered on nine fish species in the study and have been known to cause mortalities of fishes (Davis 1961).

DISCUSSION AND CONCLUSIONS

The results of this survey suggest that the numbers of parasite species and both the prevalence and intensity of infection of fish with parasites, has increased since an earlier survey in 1938-42. Major increases in the number of species were evident in the protozoans, monogeneans and digenean trematodes (Table 1). The increase in parasite taxa shown in Table 1 was generally more pronounced for the nearshore, warmwater fish community (golden shiner, creek chub, white sucker and dace) than for the coldwater, salmonid community (lake whitefish, round whitefish, brook trout, lake trout).

Two hypotheses are discussed which can explain the observed changes in parasite fauna. The first hypothesis is that the differences between our results and those of Bangham (1941) and Bangham and Venard (1946) reflect differences in techniques and improvements in our taxonomic understanding of fish parasites. We feel that these differences have played a minor role in the observed changes. The parasitological examination of fish in our study and in Bangham's was as similar as possible and both Bangham (1941) and Mizelle and Donahue (1944) were familiar with most of the parasites we have reported as new records. Earlier surveys may have overlooked parasite species that occur at either low intensities or low prevalence due to seasonal changes and natural fluctuations in parasite populations, but this is not a sufficient explanation for all of our observations.

The second hypothesis refers to the changes that have occurred in the aquatic communities of Algonquin Park lakes, possibly as a result of cultural stresses on these communities. This hypothesis is partially supported by the differential changes in the protozoan, digenean and monogenean parasite groups and the relative changes in parasite loads of warmwater and coldwater fishes. Although the cultural stresses may inherently imply eutrophication and its consequences, another important stress that should not be ignored is the possibility that the introduction of bait-fish by anglers (through bait dumping) after the Second World War and through the 1960s may have added several parasite species to Algonquin Park lakes. The number of parasite taxa increased substantially from 1939-42 to 1961-71 (Table 1) for both cyprinids (62-104) and catostomids (24-37). We suggest that this dumping of fish, whether the species was present or not, was a source of fish parasite introduction.

The complex of parasites is determined by interactions between the parasite and its hosts (both fishes and intermediate hosts such as crustaceans, oligochaetes, ephemeropterans and molluscs). These interactions, as well as changes in the environment due to either natural or cultural eutrophication, will affect both the probability of infection and the parasite complex (Colby et al. 1972; Nümann 1972; Regier 1974).

Environmental changes in the main bodies of Algonquin Park lakes have been relatively minor, but the inshore areas have undergone increasingly rapid cultural eutrophication and these changes, together with the transplantation of stocks such as smallmouth bass and lake herring and the continued exploitation of extant stocks such as lake trout, have placed major stresses on the aquatic communities of these lakes (Martin and Fry 1972).

The protozoans, monogeneans, and digeneans are species groups characteristic of eutrophic habitats and they showed the greatest increases in species numbers between the surveys conducted in the 1940s and this one. Intensity of infection is usually correlated with prevalence of infection, since an increase in numbers of parasites will be associated with an increase in the number of infected hosts. Also, increases in the intensity and prevalence of infection, related to eutrophica-

tion, may lead to either mass mortalities or slow growth of fishes (Grimaldi and Nümann 1972; Nümann 1972).

ACKNOWLEDGEMENTS

We gratefully acknowledge the late N.V. Martin, as well as D. Cucin and the staff of the Harkness Memorial Laboratory for their considerable assistance. Particular thanks to J.M. Fraser for help in the collection of fish specimens from many experimental lakes. The late K.H. Loftus provided encouragement to begin the study, A.H. Lawrie supported its continuation and both critically reviewed the manuscript. We appreciate the valuable review by F. Hicks, OMNR, Algonquin Fisheries Assessment Unit. Special thanks to Fern Coulter, Debbie Schroeder and Mary Hirst for typing a difficult manuscript.

REFERENCES

ALLEN, R. L., T. K. MEEKIN, G. B. PAULEY, and M. P. FUJIHARA. 1968. Mortality among chinook salmon associated with fungus *Dermocystidium*. J. Fish. Res. Board Can. 25: 2467-2475.

ALLISON, R., and H. D. KELLY. 1963. An epizootic of *Ichthyophthirius multifiliis* in a river fish population. Prog. Fish-Cult. 25: 149-150.

ARME, C., and R. W. OWEN. 1968. Occurrence and pathology of *Ligula intestinalis* infection in British fishes. J. Parasitol. 54: 272-280.

BANGHAM, R. V. 1941. Parasites of fish of Algonquin Park lakes. Trans. Am. Fish. Soc. 70: 161-171.

BANGHAM, R. V. 1955. Studies in fish parasites of Lake Huron and Manitoulin Island. Am. Midl. Nat. 53: 184-194.

BANGHAM, R. V., and C. E. VENARD. 1946. Parasites of fish of Algonquin Park lakes. Univ. Toronto Stud., Biol. Ser. No. 53. Publ. Ont. Fish. Res. Lab. 65: 33-46.

BEFUS, A. D, and R. S. FREEMAN. 1973a. *Corallobothrium parafimbriatum* sp. n. sp. and *Corallotenia minutia* (Fritts, 1959) comb. n. (Cestoda: Proteocephaloidea) from Algonquin Park, Ontario. Can. J. Zool. 51: 243-248.

BEFUS, A. D., and R. S. FREEMAN. 1973b. Life cycles of two *Corallobothrium* cestodes (Proteocephaloidea) from Algonquin Park, Ontario. Can. J. Zool. 51: 249-257.

BEVERLEY-BURTON, M. 1984. Monogenea and Turbellaria, p. 5-209. *In* L. Margolis and Z. Kabata [ed.] Guide to the parasites of fishes of Canada. Part I. Can. Spec. Publ. Fish. Aquat. Sci. 74. 209 p.

CANNON, L. R. G. 1972. Studies on the ecology of the papillose allocreadiid trematodes of the yellow perch in Algonquin Park, Ontario. Can. J. Zool. 50: 1231-1239.

CANNON, L. R. G. 1973. Diet and intestinal helminths in a population of perch, *Perca flavescens*. J. Fish. Biol. 5: 447-457.

COLBY, P. J., G. R. SPANGLER, D. A. HURLEY, and A. M. McCOMBIE. 1972. Effect of eutrophication on salmonid communities in oligotrophic lakes. J. Fish. Res. Board Can. 29: 975-983.

CONE, D. K., and R. C. ANDERSON. 1977. Parasites of pumpkinseed (*Lepomis gibbosus* L.) from Ryan Lake, Algonquin Park, Ontario. Can. J. Zool. 55: 1410-1423.

DAVIS, H. S. 1944. Infectious diseases among wild fishes. Trans. Am. Fish. Soc. 74: 21-25.

DAVIS, H. S. 1961. Culture and diseases of game fishes. Univ. Calif. Press, Berkley and Los Angeles. 332 p.

DEARDORFF, T. L., and R. M. OVERSTREET. 1980. Review of *Hysterothylacium* and *Iheringascaris* (both previously - *Thynnascaris*) (Nematoda: Anisakidae) from the northern Gulf of Mexico. Proc. Biol. Soc. Wash. 93: 1035-1079.

DECHTIAR, A. O. 1972a. Parasites of fish from

Lake of the Woods, Ontario. J. Fish. Res. Board Can. 29: 275-283.

DECHTIAR, A. O. 1972b. New parasite records for Lake Erie fish. Great Lakes Fish. Comm. Tech. Rep. 17. 19 p.

DUGUID, J. B., and E. M. SHEPPARD. 1944. A *Diphyllobothrium* epidemic in trout. J. Parasitol. Bacteriol. 56: 73-80.

ELSER, H. J. 1955. An epizootic of ichthyophthiriasis among fishes in large reservoirs. Prog. Fish Cult. 17: 132-133.

FISHER, H., and R. S. FREEMAN. 1969. Penetration of parental plerocercoids of *Proteocephalus ambloplitis* (Leidy) into the gut of smallmouth bass. J. Parasitol. 55: 766-774.

FREEMAN, R. S., and B. H. THOMPSON. 1969. Observation on transmission of *Diphyllobothrium* sp. (Cestoda) to lake trout in Algonquin Park, Canada. J. Fish. Res. Board Can. 26: 871-878.

GRIMALDI, E., and W. NÜMANN. 1972. The future of salmonid communities in the European subalpine lakes. J. Fish. Res. Board Can. 29: 931-936.

GUILFORD, H. G. 1963. New species of myxosporidia found in percid fishes from Green Bay (Lake Michigan). J. Parasitol. 49: 474-478.

HANEK, G., K. MOLNER, and C. H. FERNANDO. 1975. New and previously known *Dactylogyrus* spp. from southern Ontario fishes. J. Parasitol. 61: 421-426

HARRIS, M. T., and A. WHEELER. 1974. *Ligula* infestation in bleak, *Alburnus alburnus* (L.) in the Tidal Thames. J. Fish. Biol. 6: 181-188.

HINES, R. S., and D. T. SPIRA. 1974. Ichthyophthiriasis in the mirror carp *Cyprinus carpio* (L.). IV. Physiological dysfunction. J. Fish. Biol. 6: 365-371.

KABATA, Z. 1970. Crustacea as enemies of fishes. *In* S.F. Snieszko and H.R. Axelrod [ed.] Diseases of fishes, Book 1. T.F.H. Publications, Jersey City, NJ. 171 p.

KLASSEN, G. J., and M. BEVERLEY-BURTON. 1985. *Ligictaluridus* Beverley-Burton, 1984 (Monogenea: Ancyrocephalidae) from catfishes (Siluriformes: Ictaluridae) in North America with redescriptions of the type species, *Ligictaluridus pricei* (Mueller, 1936), and three others. Can. J. Zool. 63: 715-727.

KUITUNEN-EKBAUM, E. 1937. *Diphyllobothrium* sp. Plerocercoid in the lake trout from Algonquin Park, Ontario. Fish. Res. Board Can. Ms. Rep. (Biol.) 302. 3 p.

LAHAV, M., and S. SARIG. 1973. Observation of laboratory infection of carp by *Ichthyophthirius multifiliis* Foquet. Bemidgen 25: 3-9.

MacLULICH, D. A. 1943a. *Proteocephalus parallacticus*, a new species of tape-worm from lake trout, *Cristivomer namaycush*. Can. J. Res. (D) 21: 145-149.

MacLULICH, D. A. 1943b. Parasites of trout in Algonquin Provincial Park, Ontario. Can. J. Res. (D) 21: 405-412.

MARGOLIS, L., and J. R. ARTHUR. 1979. Synopsis of the parasites of fishes of Canada. Bull. Fish. Res. Board Can. 199. 269 p.

MARTIN, N. V., and F. E. J. FRY. 1972. Lake Opeongo: effects of exploitation and introduction on the salmonid community. J. Fish. Res. Board Can. 29: 795-805.

MEYER, F. P. 1958. Helminth of fishes from Burnbull Lake, Clay County, Iowa. Proc. Iowa Acad. Sci. 65: 477-516.

MIZELLE, J. D. 1938. Comparative studies on trematodes (Gyrodactyloidea) from gills of North American freshwater fishes. Ill. Biol. Monogr. 17. 81 p.

MIZELLE, J. D., and M. A. DONAHUE. 1944. Studies on monogenetic trematodes. XI. Dactylogyridae from Algonquin Park fishes. Am. Midl. Nat. 31: 600-624.

NÜMANN, W. 1972. The Bodensee: effects of exploitation and eutrophication on the salmonid community. J. Fish. Res. Board Can. 29: 833-841.

PETRUSHEVSKI, G. K., and E. P. KOGTEVA. 1954. Vlyanie parasitarnych zabolevanii na upitannosty ryh. (The effect of parasitic diseases on the condition of fish.) Zool. Zhurnal. 33: 395-405. (In Russian)

PROST, M. 1963. Investigation on the development and pathogenicity of *Dactylogyrus anchoratus* (Dug. 1845) and *D. extensus* Mueller and VanCleave, 1932, for breeding carps. Acta Parasitol. Pol. 11: 17-47.

PUTZ, R. E., G. L. HOFFMAN, and C. E. DUNBAR. 1965. Two new species of *Plistophora* (Microsporidea) from North American fish with a synopsis of Microsporidea of freshwater and euryhaline fishes. J. Protozool. 12: 228-236.

REGIER, H. A. 1974. Fish ecology and its application. Mitt. Int. Ver. Limnol. 20: 273-286.

ROBINS, C. R., R. M. BAILEY, C. E. BOND, J. R. BROOKER, E. A. LACHNER, R. N. LEA, and W. B. SCOTT. 1980. A list of common and scientific names of fishes from United States and Canada. Fourth Ed. Am. Fish. Soc. Spec. Publ. 12. 174 p.

RUPP, R. S., and M. C. MEYER. 1954. Mortality among brook trout, *Salvelinus fontinalis*, resulting from attacks of freshwater leeches. Copeia 4: 294-295.

SINCLAIR, N. R. 1972. Studies on heterophyid trematode *Apophallus brevis*, the "sand-grain grub" of yellow perch (*Perca flavescens*). II. The metacercaria: position, structure and composition of the cysts; host; geographical distribution and variation. Can. J. Zool. 5: 357-364.

SMITH, H. D., and L. MARGOLIS. 1970. Some effects of *Eubothrium salvelini* (Schrank, 1790) on sockeye salmon, *Oncorhynchus nerka* (Walbaum), in Babine Lake, British Columbia. J. Parasitol. 56(4, Sect. 2, Pt. 1): 321-322.

SPRINKLE FASTZKIE, J., and J. L. CRITES. 1977. A redescription of *Eustrongylides tubifex* (Nitzsch 1819) Jägerskiöld 1909 (Nematoda: Dioctophymatidae) from mallards (*Anas platyrhynchos*). J. Parasitol. 63: 707-712.

TEDLA, S., and C. H. FERNANDO. 1970. On the characterization of the parasite fauna of yellow perch (*Perca fluviatilis* L.) in five lakes in southern Ontario, Canada. Helminthologia (Bratisl.) 11: 23-33.

THOMPSON, D. H. 1927. An epidemic of leeches on fish in Rock River, Ill. Nat. Hist. Surv. Bull. 17: 195-201.

TRIPATHI, Y. R. 1959. Monogenetic trematodes from fishes of India. Indian J. Helminthol. 9: 1-149.

VIK, R. 1965. Studies of the helminth fauna of Norway. VI. An experiment in the control of *Diphyllobothrium* infections in trout. Meddr. Zool. Mus. Oslo 75: 76-78.

WALES, J. H. 1958. Intestinal flukes as a possible cause of mortality of trout. Calif. Fish Game 44: 350-352.

WILLIAMS, H. H. 1967. Helminth diseases of fish. Helminthol. Abstr. 36: 261-295.

Appendix A. Classification of parasites of fishes from Algonquin Park lakes, 1961-1971.

PROTOZOA

Dermocystidium sp.
Eimeria degiustii Molnar and Fernando 1974
Henneguya brachyura Ward 1919
Henneguya doori Guilford 1963
Henneguya exilis Kudo 1929
Ichthyophthirius multifiliis Fouquet 1876
Myxobolus conspicuus Kudo 1929
Myxobolus couesii Fantham, Porter and Richardson 1939
Myxobolus inornatus Fish 1939
Myxobolus notemigoni Lewis and Summerfelt 1964
Myxobolus osburni Herrick 1936
Myxobolus sp.
Myxosoma bibullatum Kudo 1934
Myxosoma cyprini Spall 1974
Myxosoma pendula Guilford 1967
Myxosoma procerum Kudo 1934
Nosema pimephales Fantham, Porter and Richardson 1941
Pleistophora sp.
Sanguinicola occidentalis Van Cleave and Mueller 1932
Sanguinicola sp.
Thelohanellus notatus (Mavor 1916) Kudo 1933
Trichodina urinaria Dogiel 1940
Trichodina sp.
Trichodinella sp.

TREMATODA-DIGENEA

Allocreadium lobatum Wallin 1909
**Apophallus brevis* Ransom 1920
**Apophallus imperator* Lyster 1940
Bunodera eucaliae Miller 1936
**Clinostomum marginatum* (Rudolphi 1819) Braun 1899
**Crassiphiala bulboglossa* Haitsma 1925
Crepidostomum farionis (O.F. Müller 1784) Luhe 1909
Crepidostomum sp.
**Diplostomulum scheuringi* (Hughes 1929)
**Diplostomulum spathaceum* (Rudolphi 1819) Braun 1893
**Echinochasmus* sp.
Phyllodistomum lysteri Miller 1940
Phyllodistomum notropidus Fischthal 1942
Phyllodistomum semotili Fischthal 1942
Phyllodistomum sp.
Sanguinicola occidentalis Van Cleave and Mueller 1932
**Tetracotyle intermedia* Hughes 1928
Tetracotyle intermedia Hughes 1928
**Tetracotyle* sp.

MONOGENEA

Acolpenteron catostomi Fischthal and Allison 1942
Anonchohaptor anomalum Mueller 1938
Cleidodiscus baldwini Dechtiar 1974
Cleidodiscus brachus Mueller 1938
Cleidodiscus megalonchus (Mueller 1936) Mizelle and Hughes 1938
Dactylogyrus atromaculatus (Mizelle 1938)
Dactylogyrus attenuatus Mizelle and Klucka 1953
Dactylogyrus aureus Seamster 1937
Dactylogyrus banghami Mizelle and Donahue 1944
Dactylogyrus bifurcatus Mizelle 1937
Dactylogyrus buddi Dechtiar 1974
Dactylogyrus chrosomi Hanek, Molnar and Fernando 1975
Dactylogyrus eos Hanek, Molnar and Fernando 1975
Dactylogyrus eucalius Mizelle and Regensberger 1945
Dactylogyrus lineatus Mizelle and Klucka 1953
Dactylogyrus luxili Rogers 1967
Dactylogyrus microphallus Mueller 1938
Dactylogyrus parvicirrus Seamster 1948
Dactylogyrus semotili Wood and Mizelle 1957
Gyrodactylus bairdi Wood and Mizelle 1957
Gyrodactylus couesius Wood and Mizelle 1957
Gyrodactylus eucaliae Ikezaki and Hoffman 1957
Gyrodactylus freemani Hanek and Fernando 1971
Gyrodactylus lacustris Mizelle and Kritsky 1967
Gyrodactylus macrochiri Hoffman and Putz 1964
Gyrodactylus nebulosus Kritsky and Mizelle 1968
Gyrodactylus spathulatus Mueller 1936
Gyrodactylus sp.
Ligictaluridus monticellii (Cognetti de Martiis 1924) n. comb.
Octomacrum lanceatum Mueller 1934
Octomacrum microconfibula Hargis 1952
Octomacrum semotili Dechtiar 1966
Pellucidhaptor catostomi Dechtiar 1969
Pellucidhaptor nasalis Dechtiar 1969
Pseudomurraytrema alabamum Rogers 1966
Pseudomurraytrema copulatum (Mueller 1938) Bykhovsky 1957
Syncleithrium fusiformis (Mueller 1934) Price 1967
Tetraonchus variabilis Mizelle and Webb 1953

CESTOIDEA

Biacetabulum sp.
**Dilepis* sp.
**Diphyllobothrium ditremum* (Creplin 1825) Luhe 1910
Eubothrium salvelini (Schrank 1790) Nybelin 1922
Hunterella nodulosa Mackiewicz and McCrae 1962
**Ligula intestinalis* (Linneaus 1758) Gmelin 1790
**Paradilepis* sp.
Paradilepis sp.
Pliovitellaria wisconsinensis Fischthal 1951

**Proteocephalus ambloplitis* (Leidy 1887)
Proteocephalus exiguus LaRue 1911
**Proteocephalus* sp.
Schistocephalus solidus (O.F. Müller 1776) Steenstrup 1857

NEMATODA
**Agamonema* sp.
Camallanus oxycephalus Ward and Magath 1917
**Eustrongylides tubifex* (Nitzsch 1819) Jägerskiöld 1909[1]
Hysterothylacium brachyurum Ward and Magath 1917
**Hysterothylacium brachyurum* Ward and Magath 1917
Philometra nodulosa Thomas 1929
Philometra sp.
**Raphidascaris acus* (Bloch 1779) Ralliet and Henry 1915
Raphidascaris acus (Bloch 1779) Ralliet and Henry 1915
**Raphidascaris canadensis* Smedley 1933
Rhabdochona canadensis Moravec and Arai 1971
Rhabdochona cotti Gustafson 1949
Rhabdochona ovifilamenta Weller 1938
Rhabdochona sp.
Spinitectus gracilis Ward and Magath 1917
**Spiroxys* sp.

ACANTHOCEPHALA
Acanthocephalus jacksoni Bullock 1962
Leptorhynchoides thecatus (Linton 1891) Kostylew 1924
Neoechinorhynchus crassus Van Cleave 1919
Neoechinorhynchus cristatus Lynch 1936
Neoechinorhynchus notemigoni Dechtiar 1967
Neoechinorhynchus pungitius Dechtiar 1971
Neoechinorhynchus rutili (O.F. Müller 1780) Hamann 1892
Neoechinorhynchus saginatus Van Cleave and Bangham 1949
Neoechinorhynchus strigosus Van Cleave 1949
Pomphorhynchus bulbocolli Linkins in Van Cleave 1919

ANNELIDA-HIRUDINEA
Actinobdella sp.
Cystobranchus verrilli Meyer 1940
Myzobdella moorei (Meyer 1940) Meyer and Moore 1954
Piscicola sp.

MOLLUSCA
*Glochidia

---

[1]Sprinkle Fastzkie and Crites (1977) redescribed *Eustrongylides tubifex*.

ARTHROPODA-CRUSTACEA

Achtheres micropteri Wright 1882
Ergasilus caeruleus Wilson 1911
Ergasilus celestis Mueller 1936
Ergasilus centrarchidarum Wright 1882
Ergasilus elongatus Wilson 1916
Ergasilus sp.
Salmincola thymalli (Kessler 1868) Wilson 1915

ONTARIO FISHERIES TECHNICAL REPORT SERIES

No. 15 The effects of depth and harvest on bait fish in southern Ontario streams.
C.B. Portt. 1985.

No. 16 Early life studies of lake whitefish (*Coregonus clupeaformis*), cisco (*Coregonus artedii*) and yellow perch (*Perca flavescens*) in Lake Opeongo, Ontario.
D. Cucin and D.J. Faber. 1985.

No. 17 The sensitivity of Ontario lake trout (*Salvelinus namaycush*) and lake trout lakes to acidification.
G.L. Beggs, J.M. Gunn and C.H. Olver. 1985.

No. 18 Movements of rainbow trout (*Salmo gairdneri*) and splake (*Salvelinus fontinalis* x *S. namaycush*) in a small Ontario lake as revealed by ultrasonic telemetry.
G. Betteridge. 1985.

No. 19 The Lake Opeongo creel survey.
M.J. McMurtry and B.J. Shuter. 1985.

No. 20 Water drawdown and its effects on lake trout (*Salvelinus namaycush*) reproduction in three south-central Ontario lakes.
M.L. Wilson. 1985.

No. 21 Standing stock estimates of benthic fauna for a lake set in northwestern Ontario.
K.I. Cullis. 1986.

No. 22 Returns of hatchery-reared lake trout from eight lakes in northeastern Ontario.
M.J. Powell, M.-F. Bernier, S.J. Kerr, G. Leering, M. Miller, W. Samis and M. Pellegrini. 1986.

No. 23 Proceedings of a workshop on the lake sturgeon (*Acipenser fulvescens*).
C.H. Olver, Editor. 1987.

No. 24 Long-term impacts of highway construction on Mill Creek, Ontario.
J.N. Bowlby, J.G. Imhof, R.M. Biette and D.P. Dodge. 1987.

No. 25 Physiological response of walleye (*Stizostedion vitreum vitreum*) to hooking/playing and hooking/holding stress.
M.S. Sobchuk and N. Dawson. 1988.

No. 26 Comparative properties of rivers and lakes from an Ontario perspective.
R.A. Ryder and J. Pesendorfer. 1988.

No. 27 A bridle-less trawl and fine-mesh purse seine for sampling pelagic coregonine larvae with observations of spatial distribution and abundance.
D.O. Evans and P.R. Johannes. 1988.

No. 28 Comparative survival and growth of F_1 wild and F_3 generations of the same strain of hatchery-reared brook trout (*Salvelinus fontinalis*) planted in two small lakes.
J.M. Fraser and C. Rumsey. 1988.